

## Book Review

**Carbocyclic Three-Membered Ring Compounds, Houben-Weyl, Methods of Organic Chemistry, Volumes E17a–d.** Edited by A. de Meijere. Thieme: Stuttgart, 1996, 3635 pp., hardback. E17a, ISBN 3-13-218704-6, 988 pp., DM 2550. E17b, ISBN 3-13-798204-9, 1000 pp., DM 2950. E17c, ISBN 3-13-101634-5, 764 pp., DM 2750. E17d, ISBN 3-13-101644-2, 960 pp., DM 2950.

This monumental four-volume set in the Houben-Weyl series can be regarded as the sequel to the single volume entitled "Carbocyclic Three- and Four-Membered Ring Compounds" published 25 years ago. The massive increase in size to 3194 densely packed pages (exclusive of the indexes) reflects the enormous level of development of cyclopropane chemistry during this time frame. Taken together, Volumes 17a-17d constitute, as a consequence of the very exhaustive treatment of three-membered ring chemistry provided therein, the most important reference source in this field. There are no other books that discuss, in whole or in part, a subject of obviously broad interest in such a comprehensive and up-to-date manner.

Volumes 17a and 17b deal with the synthesis of cyclopropanes from all possible aspects. The five major headings encompass *de novo* three-membered ring construction, carbon framework rearrangement processes, cycloaddition routes, ring contraction methods, and transformations from other cyclopropanes. In typical Houben-Weyl fashion, each chapter is logically dissected into highly specialized subsections written by an expert in the field. For example, the first chapter is constituted of more than 230 subsections. Each subsection is clearly illustrated, informatively presented, and adequately cross-referenced to related topics.

Volume 17c is devoted to chemical transformations of cyclopropanes and to their coordination chemistry. The constituent chapters discuss ring-opening reactions of nonactivated, donor-substituted, acceptor-substituted, and donor-acceptor-substituted cyclopropanes, cycloadditions of all types, C<sub>1</sub>-extrusion processes, rearrangement reactions with and without ring opening, ring expansions, and various aspects of complexation involving the cyclopropane system by a transition metal. The last section is very short (7 pages of text) and admittedly does not give a full account of this exciting field. This is indeed unfortunate as the few general outlines of reaction types only whet the reader's appetite to see more. Of particular importance is the fact that this section is out of step with the great majority of the work, which is exceedingly rich in information.

Volume 17d is concerned principally with the synthesis, transformations, and coordination chemistry of cyclopro-

panes and cyclopropenes, together with thiafulvenes, calicenes, quinocyclopropanes, cyclopropenones and their heteroanalogs, and cyclopropenylium salts. As in the earlier volumes, the surveys are amazingly authoritative in general and rich in illustrative detail. Also, the underlying organization makes it easy to locate rapidly those topics of specific interest. Approximately half of this volume also houses the invaluable compound and author indexes, which cover all four volumes. The compound index is composed of a section that lists molecular formulas and four sections that contain structural formula information (open-chain, mono- and bicyclic compounds; tri-, tetra- and polycyclic compounds; spiro compounds; and symmetrical bi-compounds). The reader will find it useful simply to scan these collections of structural formulas for the purpose of gleaning some measure of the richness and diversity of this field.

The references for each subsection are clustered at the end of the relevant discussion. This important information is easy to locate since the publishers have been intent on making these massive tomes user friendly and placing in italics at the bottom of each right page the phrase *for references see p xxx*. The presentation is reasonably uniform, a likely consequence of the efforts of an editorial staff of six native speakers. Since the artwork was redrawn by a team of four professionals, the structural formulas have a homogeneous look. This is not to say that they are free of errors, which invariably plague undertakings of this magnitude. These range from minor (**2** on p 365; **17** on p 1097; **50** on p 1209) to more serious (**20-22** on p 1181; **23** → **24** on p 1919), and include an occasional error in the layout of a synthetic scheme (top of p 1191).

Notwithstanding, these four excellent volumes fill a very basic need in this area. Their content and layout will allow the non-specialist in cyclopropane chemistry to locate desired information quickly and efficiently. As a consequence of the extensive coverage, those experts in the area will quickly come to recognize that their personal experience touches only a fraction of the material contained therein. At the same time, there is a serious omission. Apparently, a chapter dealing with cyclopropane-containing natural products was not commissioned due to a perceived excess in page length for the overall series. This omission would have added richly to the other topics, as recognized by the editor himself who primes the reader several times in the preface by making comment on the importance and relevance of biologically active cyclopropane derivatives, as well as to the current efforts being directed toward the enantioselective total syntheses of many such compounds found in nature.

**Leo A. Paquette**, The Ohio State University, USA

**Carbocyclic Four-Membered Ring Compounds, Houben-Weyl, Methods of Organic Chemistry, Volumes E17e–f.** Edited by A. de Meijere. Thieme: Stuttgart, 1997, 1321 pp., hardback. E17e, ISBN 3-13-101654-X, 632 pp., DM 2200. E17f, ISBN 3-13-107774-3, 800 pp., DM 2600.

This two-volume treatise documents in scholarly fashion all of the important developments in the field of carbocyclic four-membered ring chemistry for the last 40 years. The comprehensive and up-to-date features of this overview, including the citation of nearly every paper published in the field, instill an encyclopedic quality that makes it a superb reference resource. The subsections of each chapter have been written by experts who have most often carried out research in the area. Whereas this partitioning of duties often gives rise to redundancy, good editing has minimized this potential disadvantage to a significant degree.

The first volume begins with a 27-page introduction that is an exact duplicate contained in the companion four-volume work entitled "Carbocyclic Three-Membered Ring Compounds". Although a detailed discussion of the theoretical models of bonding, energies, and spectroscopy of both small-ring systems is contained therein, this reviewer considers this republication to be a waste of space. A one-sentence statement directing the reader to the other location would have sufficed.

Volume 17e, which describes the synthesis and transformations of cyclobutanes from every possible perspective, is strong in every detail. A great deal can be learned from the reading of this exhaustive summary, which makes one feel the pulse and excitement of this area of chemistry. As is typical of the Houben-Weyl series, experimental procedures describing the preparation of key compounds or the application of an important technique are generously dispersed throughout the text. The organization of material is very sensible, the authors striving continuously to avoid the pitfalls associated with fragmentary documentation. Thus, one is first exposed to the construction of cyclobutanes in turn from C<sub>4</sub> building blocks, from C<sub>3</sub> and C<sub>1</sub> combinations, and from two of the same or different C<sub>2</sub> units. Subsequently, one is introduced to rearrangements involving the carbon

framework, ring expansion and ring contraction routes, and to transformations from other cyclobutanes. Each topic is compartmentalized into sections that cover a specific facet of the subject. This treatment facilitates the pinpointing of particular processes of interest and makes for provocative reading that encourages at least a glance at the neighboring sections.

Volume 17f is devoted to a detailed discussion of the synthesis, transformations, and coordination chemistry of cyclobutenes (this topic representing approximately 50% of the total space), cyclobutenediones, cyclobutadienes, and their benzo-fused derivatives. As in the previous volume, the coverage is extensive and very well referenced. Although the literature citations are clustered at many points throughout the text, the ones pertinent to any section are readily located because each *recto* page specifies on which page the relevant references may be found. This very attractive and useful feature is matched by the high quality of the illustrative formulas which are almost entirely free of errors (for exceptions, see formula 3 on page 559 and 54 → 55 on page 627).

The style of presentation throughout is factual and phenomenological. Therefore, one should not expect to find discourses on the relative merits of different approaches or insightful presentations of evolving areas of interest. Rather, one is presented with a global dictionary of past findings in a well organized manner. The formula, structural, and author indexes are also very well laid out and together span 156 pages.

Overall, these volumes represent the only complete, stand-alone coverage of four-membered ring chemistry and easily qualify as a very useful reference work. It is strongly recommended not only for the novice in the field, but also for researchers who are currently active in the area. Instructors and students of upper level synthetic organic chemistry courses will discover these volumes to be a useful resource. Unfortunately, the high cost of the six-volume set (Volumes 17a-f), which includes both cyclobutanes and cyclopropanes, is such that it will likely be found only in libraries since few will find it possible to invest in a personal copy either singly or as a collective set.

**Leo A. Paquette**, The Ohio State University, USA

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